SECTION 17200 - STRUCTURED CABLING GENERAL PROVISIONS

PART 1 - GENERAL

The Loudoun County Cabling Standards contained in the IFB shall serve as the standard for the telecommunications cabling and shall take precedence over any conflicting language contained in this section.

1.1 DESCRIPTION OF WORK

A. The Systimax SCS certified Cabling Provider shall furnish a Bid to Division 16 for the 17200 series scope of work. All conduit and power required to support the 17200 series systems are furnished and installed by Division 16.

B. Provide all labor, equipment, supplies and materials for the complete installation of the systems described in this division. The work includes the following, as well as work not listed below but described elsewhere as it applies to copper and fiber cable plants:

1. Raceway and cable trays
2. Telephone and data cabling terminations.
3. Optical fiber and terminations.
4. Telecommunications outlets.
5. Terminal blocks/cross-connect systems.
6. Equipment racks and cabinets.
7. Patch Panels.
8. Patch Cords and Equipment Cords. (Provided by L. County DIT Department).
9. System testing.
10. Documentation and submissions.
11. Cable Management Database.

C. Interpretation of Contract Documents

1. This section of the specifications describes general provisions applicable to every section of Division 17200 Series.

2. Mention in these specifications or indications and/or reasonable implications whereby articles, materials, operation or methods related to execution of the work are noted, specified, drawn or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and accessories required for execution thereof.

3. No exclusions from, or limitations in, the language used in the specifications shall be interpreted as meaning that the accessories necessary to complete any required system or item of equipment are to be omitted.

4. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

5. Furnish and install all materials for systems, resulting upon completion, in functioning systems in compliance with performance requirements specified. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from furnishing such parts.

1.2 SCOPE AND RESPONSIBILITY

A. General Contractor

1. Include detailed scheduling information for Systimax SCS Cabling System installation and testing in the construction schedule.

2. Provide coordination to ensure Telecommunication spaces are completed, cleaned and have conditioned air as early as possible to facilitate completion of Structured Cabling System wiring and terminations.

3. Provide coordination of the Structured Cabling System installation with the Structured Cabling Provider and Division 16.

4. Conduct periodic coordination meetings between contractors to make everyone aware of critical areas of construction. Distribute the meeting minutes and attendance to the Owner/User's Representative, the Architect and the Owner/User in a timely fashion.

5. Provide coordination with Division 16 and the Structured Cabling Provider to complete the inspection described in paragraph 3.1 INSPECTION.

B. Division 16

1. Furnish and install complete raceway systems as specified herein, indicated on the drawings and listed below;

    a. Division 16

2. Coordinate electrical requirements of the Structured Cabling System with the General Contractor and Structured Cabling Provider.

3. Furnish and install a complete raceway system as indicated on Contract Documents.

4. Provide connection of the Telecommunications Grounding System to the electrical ground system per NEC, as shown in the Project Documents and as directed by the Structured Cabling Provider.

C. Systimax SCS system Provider

1. Furnish and install all devices, equipment, and appurtenances resulting in complete, functional, and fully operational systems as specified herein, indicated on the drawings and listed below;

   a. Section 17250 - Backbone System Cabling
   b. Section 17260 - Horizontal System Cabling

2. Provide coordination of the installation and electrical requirements of the Systimax SCS System with the General Contractor and Division 16.

3. Complete the inspection described in paragraph 3.1 INSPECTION.

4. Provide a detailed design which must be prepared and certified by the Systimax SCS system Provider's RCDD.

5. Provide termination of all cabling for the Systimax SCS System.

6. Prior to fabrication, coordinate exact location and installation of devices with other trades.

7. Provide complete system test in accordance with SYSTIMAX SCS requirements and provide owner with Systimax SCS 20 year warranty.

1.3 RELATED DOCUMENTS

A. General

1. Drawings, specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification

sections, apply to work of this section. The General Contractor and all subcontractors are responsible for locating information pertaining to required items of work specified or indicated elsewhere in the Contract Documents.

B. Related Work Specified Elsewhere

1. Division 0 - BIDDING REQUIREMENTS
2. Division 1 - GENERAL REQUIREMENTS
3. Division 16 - ELECTRICAL

C. Reference Specifications, Materials, and/or Codes

1. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits and pay all required fees.

2. All work shall conform to the National Electrical Code (NEC).

3. All work shall conform to all Federal, State and Local ordinances.

4. Where applicable, all fixtures, equipment and materials shall be as approved or listed by the following:

   a. Factory Mutual Laboratories (FM).
   b. Underwriters Laboratories, Inc. (UL).
   c. National Electrical Manufacturers Association (NEMA).

5. Reference specifications, materials and codes indicated minimum requirements. Design drawings and specification sections shall govern in those instances where requirements are greater than those specified in reference to specifications, materials and codes.

6. All material and equipment shall be listed, labeled or certified by Underwriters' Laboratories, Inc. where such standards have been established. Equipment and material, which are not covered by UL Standard, will be accepted provided equipment and material are listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class, which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered, if inspected or tested in accordance with national industrial standards such as NEMA, ICEA or ANSI. Evidence of compliance shall include certified test reports and

definitive shop drawings. NOTE: It is not required that the final installed system be UL listed as a single product.

7. All work shall meet or exceed the standards and procedures of the following:

   a. Federal Communications Commission (FCC):

      1) Part 15
      2) Part 68
      3) Loudoun County Cabling Standards

   b. American National Standard Institute/Telecommunications Industries Association/Electronics Industries Association (ANSI/TIA/EIA):

      1) Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA - 568B-1, 568B-2, 568B-3
      2) Commercial Building Standard for Telecommunications Pathways and Spaces ANSI/TIA/EIA – 569, 569A.
      3) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings ANSI/TIA/EIA - 606.
      4) Commercial Buildings Grounding and Bonding Requirements for Telecommunications ANSI/TIA/EIA - 607.
      5) Performance Specifications for field Testing of Unshielded Twisted-Pair Cabling Systems TIA/EIA TSB-67.

   c. National Fire Protection Association
   d. Newton's Telecom Dictionary
   e. National Electrical Code (NEC)
   f. American National Standards Institute (ANSI)
   g. National Electrical Manufacturers Association (NEMA)
   h. American Society of Testing Materials (ASTM)
   i. Institute of Electronic & Electrical Engineers (IEEE)
   j. Underwriters Laboratory (UL)
   k. Americans With Disabilities Act (ADA)
   l. Telecommunications Industry Association (TIA)
   m. Electronics Industries Association (EIA)
   n. Building Industry Consulting Service International (BICSI)

8. Include all items of labor and material required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

1.4 QUALITY ASSURANCE

A. General

1. Furnish and install only new equipment and materials required (less than 1 year from manufacture), unused without blemish or defect.

2. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code Ratings, UL label, or other data, which is die-stamped into the surface of the equipment, shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases, equipment is oversized to allow for pickup loads which cannot be delineated under the minimum performance.

B. Systimax SCS Provider (SCP) Requirements

1. General

a. The SCP shall coordinate the work shown in the 17200 series specification sections.

b. The SCP shall be a Systimax SCS certified company specializing in the design and fabrication structured cabling systems.

c. ANY SCP, WHO INTENDS TO SUBMIT A PROPOSAL, SHALL SUBMIT THE FOLLOWING DATA TO THE ARCHITECT IN WRITING AT LEAST TEN (10) DAYS PRIOR TO BID DATE, AND SHALL BE APPROVED BY ADDENDUM PRIOR TO BID DATE.

d. Verbal approval will not satisfy this requirement. Grounds for disqualification shall exist if it is proven that the information submitted is inaccurate or, in the opinion of the Architect, does not satisfy the requirements.

e. **Grounds for disqualification shall exist if it is proven that the information submitted is inaccurate or, in the opinion of the Architect, does not satisfy the requirements.**

2. Structured Cabling Provider (SCP) Qualifications

a. The principal members and key personnel to be assigned to the project shall each have a minimum of 10 years experience in completing projects of equal scope, quality, type, and complexity to that required herein.

b. Minimum of five years experience installing Systimax SCS Systems.

c. Minimum of five Systimax SCS Systems, of similar size and scope, installed and operational for a minimum of one year.

d. Minimum of one BICSI Registered Communications Distribution Designer (RCDD) employed or contracted by the Structured Cabling Provider.

e. Project Lead Technician

1) **Avaya SYSTIMAX Trained and Certified.**
2) Minimum 5 years experience as Lead Technician on Systimax SCS System projects of similar size and scope

f. Project Technicians

1) **Avaya SYSTIMAX Trained and Certified.**
2) Minimum 2 years experience on Systimax SCS System projects of similar size and scope

g. Local services facility within 100-mile radius of project location.

3. SCP Technical Proposal Requirements

a. The evaluation of the prospective SCP's qualifications will be based on the technical proposal and shall include the following:

1) A history of the company that reflects the length of time the SCP has performed services similar to those required for this project.

2) Contractor Qualification Statement AIA-305A

3) Audited financial statement for the previous year.

4) Name, address, and telephone number of organization's current Bonding company and level of bonding capacity.

5) Provide a description of installation capabilities and indicate:

   a) Name, registration number and resume of certifying BICSI RCDD.
   b) Name, **Avaya SYSTIMAX** certification number and resume of Lead Technician.
   c) Name, **Avaya SYSTIMAX** certification number and resume of Technician(s).
   d) Name and resume of the project manager that will be assigned the project.

6) List of at least 5 comparable, completed projects (of similar size and scope, on which work has been performed, that have been operational for minimum of 1 year. Include for each facility the following:

   a) Name and location of project.
   b) Date of occupancy.
   c) Name, address, and telephone number of Owner.
   d) Name, address, and telephone number of Architect.
   e) Name, address, and telephone number of General Contractor.
   f) Name, address, and telephone number of organization's Bonding Company for the individual project.
   g) A description of the systems involved, the construction dates, and the contract amount for the equipment and services for which the SCP had responsibility.

7) List of all projects, within the last 5 years, in which the organization has been involved in litigation with a City, County, State or Federal government agency. Include summary of final decisions and status of pending litigation.

8) Copy of manufacturer's certification indicating the capability to provide a minimum 30-year guaranteed system.

b. **ALL TECHNICAL PROPOSALS WILL BE EVALUATED BY THE DOR AND THE QUALIFIED SCP'S WILL BE LISTED IN THE FINAL PROJECT ADDENDUM.**

1.5 SUBMITTALS

A. Refer to Section 01330 - Submittal Procedures

B. **IMPORTANT NOTE: ALL DESIGNS PROVIDED BY THE STRUCTURED CABLING PROVIDER MUST BE CERTIFIED BY A RCDD EMPLOYED OR CONTRACTED BY THE STRUCTURED CABLING PROVIDER.**

C. Bill of Materials

1. Provide complete bill of materials for all major components, accessories, and hardware to be provided in order to assemble a complete functioning system.

D. The Structured Cabling Provider will participate in a **MANDATORY PRE-SUBMITTAL MEETING**.

1. Location: Project Job Site
2. Time Line: Sixty (60) days after Award of Contract
3. Participants:

a. Architect
b. General Contractor
c. Division 16
d. Loudoun County Representative
e. Systimax SCS system Provider

1) Project Manager
2) Project Estimator

4. Structured Cabling Provider shall provide the initial assembly of submittal materials as described herein.

E. The formal submittal shall be transmitted 15 days after Pre-Submittal Meeting.

F. Submittal must consist of a complete package, bound in a three ring binder, including, Product Data for each Section of the 17200 series specifications, and Shop Drawings as applicable. **PARTIAL OR INCOMPLETE SUBMITTALS ARE NOT ACCEPTABLE.** The Submittal shall include the following:

1. A Title Page complete with the following required information:

   a. Project name.
   b. Date.
   c. Name and address of the Architect.
   d. Name and address of the Structured Cabling Provider.
   e. Name and address of Division 16.
   f. Name and address of the General Contractor.
   g. Name and address of any Subcontractors.

2. An Index Page complete with the following required information:

   a. Name of the Supplier.
   b. Name of the Manufacturer.
   c. Title, section and paragraph of the Specification Sections. (Example section 17150, paragraph 2.4)
   d. Products in order as specified in PART II of the related specification.

3. Each Specification section shall be separated, collated in order, and complete with the following information:

   a. Title sheet.
   b. Descriptive purpose of the system, stating how each product is to function.

4. Each Data Sheet shall have the specific reference to the Specification it is to be used for, noting the section and paragraph.

G. Shop Drawings

1. Submit shop drawings in accordance with Section 01330 for all equipment showing:

   a. Location and type of all of the following on floor plans.

      1) Work Area Outlets
      2) Wall Phone Outlets
      3) Communications Rooms

   b. Large scale (minimum 1/4"=1') floor plan and elevation view drawings of all telecommunications closets depicting all racks, consoles, cabinets, equipment, outlets, etc.
   c. Size and spacing of all anchors, wall penetrations, joinery construction, etc., required for complete system installation.
   d. Elevations of all equipment racks showing equipment mounting locations (front and rear if any equipment is rear mounted).
   e. Wire management details for the installation of cable harnesses inside racks, equipment cabinets and other areas of exposed cable.
   f. Block Diagram depicting wire connectivity to all data closets.
   g. Wiring diagrams for all field devices (work area outlets, etc.)
   h. Main Telecommunication Room layout, Telecommunications Relay Rack elevations and fiber management panel layout drawings
   i. Telecommunication Rooms layout and Telecommunications Relay Rack elevations and fiber management panel layout drawings
   j. Telecommunication Backboard layouts
   k. Telecommunication Grounding system
   l. Drawings shall include cable routes, termination points, pair and fiber assignments, labeling scheme and sample, proposed method of installation, and a schedule of work. Drawings shall also be available in electronic format compatible with Loudoun County's GIS.
   m. Contractor shall provide a minimum of (4) copies.

H. Product Data

1. **Product Data showing multiple products, models or options shall be clearly marked identifying the specific product, model and options, which are submitted for review. Unmarked submittals or facsimile copies shall not be acceptable.**

2. Submit Product Data in accordance with Section 01330 for all equipment showing:

a. Original Data Sheets Only. Fax copies are not acceptable.
b. Product performance, mechanical and electrical specifications.
c. Manufacturer's installation instructions.
d. Product test compliance certificates if required.
e. Detailed testing agenda, schedule and documentation forms for all systems as described below.

3. Submit the following information with Product Data

a. Complete list of proposed system components.
b. Technical specification of each proposed major system component.
c. Provide independent testing lab reports on each type of cable and each type of jack used.
d. Provide one meter of each type of cable and one jack of each type used.
e. Provide product data on proposed field testing equipment for final system tests.
f. Provide product demo on proposed cable management database software.

I. Samples

1. Provide samples as requested for review and approval of substitutions or as specified in Division 17200 series specifications.

J. Test Plan and Documentation

1. Submit a complete testing plan for all systems for approval with the shop Drawing/Product Data submittal.

2. Plan submitted must include field testing of each and every field device and control function. Refer to standards for more detailed testing requirements for structured UTP and fiber optic cabling.

3. Plan submitted must include examples of testing documentation. Testing documentation must be submitted when requesting final Demonstration/Inspection (described below).

K. Operating and Maintenance Data

1. Provide three (3) copies of each operating and maintenance manual for each 17200 series system. Manuals shall be bound in "D-ring" binders with a detailed table of contents.

2. The O & M manuals shall be cross-referenced to the Record Documents and contain the following information for all systems:

   a. Product catalog cut sheets and specifications of all equipment.
   b. "Hands-on" operational description of all equipment and performance features in each system using clear and understandable terminology.
   c. Detailed programming instructions for all systems and all software programs.
   d. Printed copy of all equipment settings. This is to include the final settings for all source level control, analog and digital processing, and amplification.
   e. Copy of all software programs stored on floppy disc or CD. Provide one copy for each O & M Manual, and one copy that is to be left in the rear of the equipment rack.
   f. Troubleshooting procedures to diagnose malfunctions in each system.
   g. Repair procedures for all equipment.
   h. Preventative maintenance procedures for all equipment.
   i. Table listing the model numbers for all equipment in each system including the names and phone numbers of the manufacturer and their representative directly responsible for this project.

L. Record Documents

1. Submit one (1) reproducible copy and one (1) blueline print of the "As-built" condition of all systems including:

   a. A set of updated shop drawings showing all Contract changes.
   b. A set of updated product data showing all Contract changes.
   c. Floor plan showing conduit raceway routing including all equipment rack, cabinet and pull box locations, and conduit sizes.
   d. Complete point-to-point wiring diagrams showing **ALL** equipment, devices, wire and cable (Signal, power and ground). This document shall also include all terminal block designations, abbreviations and color-coding.
   e. Transmittal letter listing delivery of complete spare parts inventory.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Refer to Section 01600 - Product Requirements

B. All products shall be new (less than one year from manufacture and unused and without blemish or defect).

C. Products that have been in manufacture for at least five years, unless otherwise specified by performance requirements.

2.2 SUBSTITUTIONS

A. Submit substitutions in accordance with Section 01600 - Product Requirements

B. No other method of substitution, except as specified in Section 01600 - Product Requirements is acceptable.

C. Deviations from specifications:

1. Any deviations from the specifications must be approved 7 days prior to the bid date. This includes changes to the scope of work, equipment substitutions, and changes to the general provision.
2. Changes to the scope of work are not acceptable. Any proposed change is to be submitted to the Architect for review. Any approved changes will be listed by addendum prior to the bid opening.
3. Any proposed equipment substitution must be submitted 7 days prior to the bid date. Accompanying the request, the contractor must provide manufactures product specifications for the exact model be substituted. This literature must clearly state all specifications called for in the bidding documents, as well as performance characteristics not specified inherent to the product listed in the specifications. Any items listed as an "Approved Equal" will be listed by addendum prior to the bid opening. Substitutions after the award of bid will only be allowed in case of discontinued equipment, or if an item of equal or better quality is available and will not affect the contract cost of the system.
4. Changes to the general provisions are not acceptable. Any proposed change is to be submitted to the Architect for review. Any approved changes will be listed by addendum prior to the bid opening.

2.3 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which

replacement parts are readily available.

B. Equipment Assemblies and Components

1. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Architect.

2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

3. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer.

4. Components shall be compatible with each other and with the total assembly for the intended service.

5. Constituent parts which are similar, shall be the product of a single manufacturer.

C. All factory wiring shall be identified on or provided with the equipment being furnished and on all wiring diagrams and included with O & M manuals.

D. When factory testing is specified:

1. The Architect shall have the option of witnessing factory tests. The SCP shall notify the Architect a minimum of 15 working days prior to the manufacturer's making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the Architect prior to final inspection and not more than 90 days after completion of tests.

3. When equipment fails to meet factory test and re-inspection is required, the SCP shall be liable for all additional expenses.

2.4 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of all Reference specifications, materials and codes, install an identification sign that clearly indicates information required for use and maintenance of items such as cabinets, control devices and other significant equipment.

B. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before installing electronic equipment, carefully inspect the installed Work of all other Trades. Verify that all such Work is complete to the point where the installation of electronic equipment may properly commence. Verify that the telecommunications closets are free of airborne contaminants prior to the installation of electronic equipment.

B. Verify that all equipment is installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

C. In the event of discrepancy, immediately notify the Architect.

D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

E. Return to original (pre-construction) condition any work disturbed during system installation.

F. Prior to installation, the SCP shall examine and measure existing construction in involved areas, report conditions that interfere with or prevent correct installations and report conflicts between documents and actual conditions.

G. The designated Voice/Data telecommunications rooms or areas will be available to the SCP on a coordinated basis with the General Contractor.

3.2 INSTALLATION

A. Install all equipment in strict accordance with the manufacturer's recommendations, reviewed shop drawings and EIA/TIA Standards for UTP and fiber optic cable.

B. Secure equipment with fasteners suitable for the use, materials, and loads encountered. If requested, submit evidence proving suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.

C. National Electrical Code requirements are applicable to all work.

D. Where the Architect determines that the SCP has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner/User. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.

3.3 WORK PERFORMANCE

A. Coordinate location of equipment with other trades to minimize interferences.

B. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Architect as required by limited working space.

C. Holes shall not affect structural sections such as ribs or beams.

D. Holes shall be laid out in advance. The Architect shall be advised prior to drilling through structural sections for determination of proper layout. The SCP shall obtain permission from the Architect before proceeding with any work necessitating cutting into or through any part of the building structure such as girders, beams, concrete, finished floors or partition ceilings.

E. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factory of 5, which shall conform with any specific requirements in the Construction Documents.

F. The SCP shall restore to original condition, at the SCP's expense, existing construction and improvement that are cut into, altered or damaged due to the SCP's operations. This includes matching adjoining surfaces and finishes.

G. The SCP shall be responsible for removing or laying aside ceiling tiles in order that it may complete its installation. When the installation has been completed in an area, the contractor shall replace the ceiling tiles immediately at the SCP's expense.

H. The SCP shall at all times keep the adjacent areas of the property free from rubbish and the accumulation of any waste material.

3.4 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

B. Prevent damage from rain, dirt, sun and ground water by storing equipment on elevated supports and covering all sides with securely fastened protective rigid or flexible waterproof coverings.

C. Protect piping by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.

D. During construction, cap the top of all conduits and raceway installed vertically.

E. During installation, protect equipment against entry of foreign matter on the inside, and vacuum clean both inside and outside before testing and operating.

F. Damaged equipment, as determined by the Architect, shall be replaced.

G. Protect painted surfaces with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.

H. Repaint damaged "FINISH" paint on equipment and materials with painting equipment and finished with same quality of paint and workmanship as used by the original manufacturer so repaired areas are not obvious.

I. The SCP shall be responsible for shipping, handling and storage of all equipment and materials, and to protect it from theft.

3.5 IDENTIFICATION

A. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.

B. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling unless indicated otherwise.

3.6 CABLE TERMINATIONS AND DRESS

A. Installation of communication conductors shall adhere to the following:

1. Furnish and install cable supports as specified.

2. All cables and/or conductors shall be terminated with approved cable termination connectors compatible with the specific termination.

3. Label all cables on both ends and on all patch panel/termination points.

3.7 CLEANING

A. Refer to Section 01700 - Execution Requirements

B. Daily during construction and prior to Owner acceptance of the building, remove from the premises and dispose of all packing material and debris caused by work performed under Division 17100 series specifications.

C. Remove all dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.8 COMPLETION

A. General

1. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and leave the premises clean, neat and orderly.

B. Results Expected

1. All equipment and materials shall be in place and all systems shall be demonstrated to be operationally complete.

2. All testing, start-up and cleaning work shall be complete.

3. All documented testing results are submitted and approved by the Architect. ANY COMPONENT OF THE SYSTEM THAT FAILS TO MEET TEST PERFORMANCE STANDARDS, SHALL BE REPLACED BY THE SCP AT NO ADDITIONAL COST.

4. The SCP shall provide test equipment to the Architect to spot check test result documentation.

5. All O & M Manuals and Record Documents are reviewed and accepted.

6. Substantial Completion inspection is performed and granted. The Substantial Completion inspection punch list is completed by the SCP.

7. All "minimum" twenty (20) year structured cable plant certifications and warranties are received.

8. Transmittal letter listing delivery of complete spare parts inventory.

C. DEMONSTRATION/INSPECTION

1. Upon completion of approved testing procedure and submittal of testing documentation as described above, the Structured Cabling Provider shall notify the Architect, who will visit the project for a demonstration of the systems and an inspection of the completed work in conformance with the Construction Documents. It is mandatory for a representative from the SCP directly responsible for the project to be present during demonstration and inspection periods.

2. Items which do not comply with the Contract Documents, or which function incorrectly, will be listed and the list will be submitted by the Architect to the Structured Cabling Provider.

3. After all corrections have been made, the Structured Cabling Provider shall notify the Architect who will recheck the system for compliance of all items listed. IF THE ARCHITECT IS REQUIRED TO RETURN TO THE SITE FOR FURTHER INSPECTIONS, ALL LABOR AND TRAVEL EXPENSES SHALL BE REIMBURSED BY THE SCP.

4. All bright metal or plated work shall be thoroughly polished. All pasted labels, dirt and stains shall be removed from the devices.

D. MAINTENANCE MATERIALS

1. All special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered in conformance with Section 01700.

2. Provide spare materials as indicated in Contract Documents and as required for proper maintenance of systems.

E. WARRANTY, WARRANTY SERVICE AND MAINTENANCE

1. Warranty

a. The Systimax SCS System shall have a factory warranty for twenty (20) years beginning on the date of Owner acceptance.

b. The Division 17100 series systems not covered under the Systimax SCS System "minimum" twenty (20) year warranty shall be fully guaranteed by the Structured Cabling Provider for a period of two (2) years beginning on the date of Owner acceptance.

c. The guarantee shall include the entire Division 17200 series scope of work including all equipment, devices, materials, cable/wire, software and installation.

d. Work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the Work of all other Trades resulting from same, shall be replaced or repaired as directed by the Owner for a period of two (2) years from the date of Owner final acceptance. The SCP shall provide written warranties for all systems and all buildings to the Owner.

e. The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.

f. Acceptance by a manufacturer of an order for equipment for this contract signifies acceptance of this warranty. During the warranty period there shall be no charge to the owner for equipment, material, software, etc. for guarantee work.

g. During the warranty period, there shall be no charges to the Owner for service calls (mileage, labor, travel, expenses, etc.) for guarantee work.

2. Warranty Service

a. Warranty service shall be provided as part of this Contract by the SCP during the warranty period.

b. Warranty service agreement must be submitted separately and must contain the name, voice phone number, facsimile phone number and pager number of the service provider capable of meeting the response time as defined by the designer.

c. This service shall consist of the following:

1) 24-hour phone number.
2) Technician's factory trained by the manufacturers of the system's components.
3) Authorized representation of the manufacturer via an agreement of factory support.
4) Five years experience (minimum) servicing systems of the type included in this project.
5) Capability of making additions or changes to the software systems used in this project.
6) Capability of servicing the individual system components and the total telecommunications system.
7) Equipment and knowledge to test all specified equipment and devices.
8) Current system documentation including but not limited to the following:

    a) Wiring diagrams.
    b) Operation and maintenance manuals.
    c) Software programs.
    d) Other documentation as required to provide assistance to the Owner/User in the operation and maintenance of the systems.
    e) All documents shall be made available to Owner/User upon request.
    f) Upon termination of maintenance agreement all system documents shall be furnished to owner for maintenance continuity.

d. The Owner and/or Architect shall notify the SCP in writing, outlining operational malfunctions or defects in the Division 17100 series Structured Cabling system. This report shall be faxed to the service provider, which will establish the date and time or problem notification.

e. Upon successful completion of warranty service, the responsible technician shall return a copy of the original service request to the Owner with a detailed description of the problem found, and corrective action taken including a list of equipment/parts/software repaired or replaced. The technician shall also sign the on-site service log at the facility.

f. Response Times:

1) Telephone Call Response: Within 1 hour of request
2) On-Site Response:

   a) M-F 8:00 a.m. to 5:00p.m. - Within 4 hours of request
   b) Saturday, Sunday or after 5:00p.m. – Response the next calendar day.

PART 4 – LOUDOUN COUNTY CABLING STANDARDS

4.1 PURPOSE OF STANDARD

A. The intent of this cabling standard is to provide a detailed document to be incorporated into all building design projects, new or rehabilitated, undertaken by the County of Loudoun and in all Requests for Proposals issued for leased space. The basis of this standard is EIA/TIA 568-A5, 569 and the proposed Category 6 standard. The purpose of this specification is to ensure that the County of Loudoun is provided with a standards compliant cabling solution with guaranteed "Channel" performance. This solution will allow the County of Loudoun to maximize productivity and value by minimizing down time and maintenance requirements, thus protecting their investment for 20 years, while still providing for a future migration path to evolving technologies.

4.2 RESPONSIBILITIES

A. The County of Loudoun Department of Information Technology (DIT) has the primary responsibility for compliance with this standard and provision of information cabling in existing County buildings, new County buildings and leased County buildings. It will be the responsibility of DIT to participate in all County Move Committee meetings to insure adequate information and voice, data, image and video cabling is provided. This includes coordination with the County Telecommunications Manager to insure adequate voice cable in conjunction with data cabling for all Moves, New Service and changed service. This responsibility includes:

1. Management of the County Information Cable Plant, both exterior and interior;
2. Coordination of all Cable Plant installation, maintenance and plant records; and
3. Provision of EIA Cabling for New Service Relocation Services and Changes In Existing Services for County owned and leased space.

4.3 DETAILS OF THE CABLING STANDARD

A. COUNTY OWNED SPACE

1. Telephone Company Demarcation Point to Main Crossconnect (MC)

   a. Minimum of 3 each 4" schedule 40 PVC conduits from the telephone room to telephone company junction point.
   b. Conduits must meet approved bending radius standards.
   c. Coordinate with VERIZON for exact number of conduits and requirements.

2. Main Crossconnect (MC)(For greater room/conduit detail, refer to ANSI/EIA/TIA 569-A.)

   a. Typically one per building, centrally located within the building.

   b. HVAC environment

      1) The room should provide a human habitable environment.
      2) No water lines should be permitted through or directly above it; ceiling must be designed to prevent water run off or spillage onto equipment or cross connect devices.
      3) The floor should be painted or tiled and free of dust generation.
      4) Designated walls should be covered in ¾ "fire rated" plywood backer board, one wall for telephone company, one for voice and one for data.
      5) The room work lighting should be at least 50 candlefoot at work area height; fluorescent lighting is preferred with sufficient illumination in all four corners of the room.

   c. Room is for exclusive use of communications equipment; no water or commercial power is to be distributed through it.
   d. Size: proportional to size of building and/or number of sets/terminals to be installed with sufficient space for a work desk and a terminal to be installed for monitoring of on site equipment. Minimum size is 150 square feet or one square foot for each 100 square feet of floor space.
   e. Electrical requirements: a minimum of one dedicated, 20 amp, isolated ground circuit terminated in National Electrical Manufacturers Association (NEMA) 5.20R receptacle on each wall. Typical spacing of receptacles for equipment is a quad every four feet of wall space. The equipment receptacles shall be served by the building UPS source (see j). All ups outlets should be wired to building back-up power, where available. Utility power shall be provided separately with one duplex outlet per every 50 SF.

f. A wall telephone is required.

g. 110P blocks or RJ45 jack fields will typically be used for termination of voice and data cables. Voice is terminated on the walls and RJ45 data panels are rack mounted in the center of the floor. Mounting hardware shall be marked with the following cable identification standards:

   a) floor #,
   b) TR,
   c) directional quadrant (N,E,S,W),and
   d) work station location.

h. Telecommunications Room (TR) should be situated directly above the Main Crossconnect (MC) in a "stacked" configuration when a building has multiple floors.

i. Conduit feed to TR (serving horizontal cable runs to station locations):

   1) Minimum of 1-4" conduit from MC to each TR. Total number of conduit will be relative to the number of devices projected to be served by the TR.
   2) Must meet approved bending radius standards.

j. The data and telecommunications systems shall be served by the building generator and uninteruptible power supply (UPS). The generator shall have at least a six hour capacity and the UPS shall be a minimum of 15 KVA.

k. Any County building with at least 150 occupants must have IT technician support space for staging and repairing computer equiment of at least 150 square feet.

3. Telecommunications Room (TR)

4. Note: For greater room/conduit detail, refer to EIA/TIA 569A.

   a. At least one per floor/area, other than the floor with MC; more required if horizontal wiring runs exceed 90 meters.

   b. All Rooms should be layed out in a stacked configuration with MC and other TRs.

   c. Size: proportional to size of building and/or number of sets/terminals to be installed with sufficient space for a work desk and a terminal to be installed for monitoring of on site equipment. Typical size is approximately 150 square feet. Under no circumstances should Telecommunications Room be less than (10ft x 7ft).

d. In all other respects not listed in this section, the TR shall meet the same specifications detailed for the MC.

5. MC and TR Distribution to Office/Workstation.

6. Note: The following wiring systems description addresses horizontal/workstation and riser cable between closets.

a. Description of Standard Wiring Systems and Associated Components:

1) A structured/universal wiring system (SYSTIMAX® SCS shall be used for interconnecting telephones, voice/data switches, local area networks (including personal computer and associated peripherals) and fax machines. These systems must have access to outside networks.

a) The wiring system, including both copper and fiber optic applications (in compliance with EIA/TIA 568-A (Commercial Building Wiring Standard) and the proposed Category 6 standard, shall utilize a set of subsystems to create a full cabling infrastructure within each building which can be quickly reconfigured to adapt to changes in technology or the user's environment. Vendors must use Avaya certified people, and provide system certification.

2) The basis for the cabling system design is the Avaya SYSTIMAX Structured Cabling System (SCS), Its components and Application guides. The basic UTP Category 6 product is rated for positive ACR to 444 MHz (Avaya xx81 series UTP) and have guaranteed performance to 550 MHz. The entire SCS system is protected by a transferable Twenty (20) year physical component warranty that includes applications and labor.

b. The SYSTIMAX SCS structured/universal system standard supports subsystem wiring. Additional features include:

1) Support of the current and evolving standards, technologies and services such as Alalog Broadband Video to 550 MHz 77 Channels, Gigabit ATM, 1000BASE–T Gigabit Ethernet, 622 Mbps 64-CAP ATM, 270 Mbps Digital Video, AES/EBU Digital Audio, 155 Mbps ATM, 100BASE-T Ethernet, 100 Mbps TP-PMD, Token Ring, 10BASE-T Ethernet, RS-485, RS-422, RS-232, ISDN

(Integrated Services Digital Network), T-1, Switched-56, Modem, Fax, Analog Baseband Video/Audio, FDDI (Fiber Distributed Data Interface), and SONET (Synchronous Optical Network).

a) Supports two types of transmission media: 1) AWG #24 unshielded twisted pair (UTP) copper as standard TIA/EIA 568-A Category 3, and proposed Category 6; 2) and, 50 micron fiber using short wave VCSEL technology to support 10 Gb/s in the backbone to 300 meters and 50/125/900 microns core/cladding diameter, multimode, graded index fiber optic cables as standard for premises (between closets and campus applications concentrator) and other campus applications.

b) Color coding at administration panels (within the MC and TRs) to identify the distribution fields should be as follows:

1 Blue: Work Location and Horizontal cables
2 White: Riser Backbone
3 Brown: Campus Backbone
4 Purple: Common equipment
5 Green: Incoming Telco trunks
6 Orange: Multiplexed output
7 Yellow: Auxiliary equipment
8 Gray: Tie cable

c. Wiring Specifics Relating to TRs and Distribution to Workstations:

1) The Telecommunications Room (TR) or wiring Room is the central point for intra-floor wiring and has a critical effect on the flexibility and maintenance of the wiring system. The TR contains cross connect blocks and certain LANcomponents such as wiring concentrators, communication controllers and multiplexers.

a) Minimum of two outlets to each office (hardwall), one to each workstation.

b) Cables will be identified at both ends with office/workroom, cable and workstation number based on numbering scheme of floor plan. Workstation numbering scheme is normally as follows: numbering starts in reception area and flows through in a logical sequence within the

department.

c) Voice - data designation.

1. Duplex jacks shall be designated with the office/workstation number plus voice and data. The top jack will be typically used for voice. The bottom jack is used for data.

d. Color of jacks. The voice jack, (top) will be white or gray, depending on location on a wall (white) or system furniture (gray).

e. The data jack will always be orange.

f. Where cables exit walls into ceiling space, conduit will be stubbed.

g. If cable is to be installed in systems furniture, ends must be rolled, labeled and tied.

B. County Owned Building that has the Old IBM Type Cabling System Installed.

1. Note Rule: If the owned building is scheduled to have work done or relocations that total at least 50% of the installed work stations, the entire building should be recabled in compliance with the OWNED SPACE specifications of this standard. If the decision by DIT is not to recable, then the new cabling shall be done according to the Owned Building Standards. Type 1 cable shall no longer be installed.

2. All jacks will terminate both voice and data except as noted hereafter:

C. COUNTY LEASED SPACE

1. Leased space should be cabled according to the Owned Building Standards. Exceptions to the Standards may be made as determined by DIT, based on the length of the lease term and programmatic requirements.

4.4 LIST OF SYSTIMAX® SCS MAJOR COMPONENTS as of May, 2001

A. The purpose of this section of the standard is to an overview of the key SCS components. This overview is provided as guidance only. The list is not all-inclusive and will change, for exact technical detail and updates the current Systimax® SCS specification should be referenced.

B. Patchmax GigaSPEED™ Distribution Hardware

1. Unshielded twisted-pair (UTP) cable termination blocks shall be a system of UL listed termination and connector blocks, label holders and insert labels utilized for cable terminators, identification and cross-connections.

    a. The Patchmax Modular Jack Panel is a 19 in. (48.3 cm) modular jack panel.

    b. The rear of the panel features 110 type Connecting Blocks mounted on a printed wiring board (PWB).

    c. These connecting blocks are intended for use in terminating stations, equipment or tie cables.

    d. The panel, which is a 19 in. (48.3cm) EIA RS-310 rack mount unit, is available with 24, 48 jacks.

2. The Patchmax Modular Jack Panels exceed the stringent requirements for connecting hardware as specified in EIA/TIA-568-A5, "Commercial Building Telecommunications Wiring Standard," when tested in accordance with the appropriate methods described in EIA/TIA-568-A5. Most importantly, the Patchmax Modular Patch Panels meet worst-pair Near End Crosstalk (NEXT) requirements over the entire frequency range for their respective categories on all pair combinations.

3. The following products shall be used for data communications:

    a. Patchmax Modular Jack Panel: PM 2160GS-24, PM 2160GS-48 Comcodes: 108 619 347, 108 619 362 respectively.
    b. D8CM CAT6 Patch Cables: D8CM-2, D8CM-4, D8CM-6, D8CM-8, D8CM-14. Comcodes: 108-566-753, 108-566-779, 108-566-795, 108-566-811, 108-669-979 respectively.

C. Unshielded Twisted Pair Cables – Category 6

1. Each conductor shall be unshielded AWG -24 solid copper and encased in a color coded plastic insulation according to the Band Marked Color Code used in standard telephone practice. Both wires in a pair shall twist around each other equally, and hence have the same length end-to-end, IAW Category 6. For a given pair, the inches per twist shall remain constant for its entire length. The twisted pair conductors shall be surrounded by an outer sheath which will be plenum. Each contractor should quote plenum cable.

2. All new cable and wire installed in building air plenums and ducts shall be flame resistant and have low smoke properties in accordance with Article

800-3(d) of the National Electrical Code and shall be so classified by Underwriters Laboratories, Inc. All wiring must comply with Article 800 of the National Electrical Code and the American Standard Institute NESC (National Electrical Safety Code) as well as any pertinent state and local codes.

D. Horizontal Cables

1. High Performance Voice/Data Cable: The voice/data wire must meet or exceed the proposed standards specifications for Category 6 cable performance. The proposed Category 6 standard shall become a part of the existing TIA/EIA 568-A5 standard and ultimately rolled into the suite of ANSI/EIA/TIA 568B Commercial Wiring Standard. Avaya 2081 cable approved

2. The cable shall be the following product:

   a. Avaya 2081-1000 ft. Reel

   b. The High Performance LAN cable (Avaya 2081) will be home run from the business locations and terminate on cross connect hardware in the respective wiring Room. The cable is capable of supporting up to 1 Gb/s Ethernet and 1.2 Gb/s ATM transmission rates for extended distances in building distribution systems.

   c. Network applications include a 16 Mb/s token ring and a 100Mb/s CAD/Image network linking multiple workstations.

Freq (MHz)	Attn dB/100m	Cat 6 Industry Standard (dB)	*81 Series* NEXT (dB)	Cat 6 Industry Standard (dB)	*81 Series* PS NEXT (dB)	CAT 6 Industry Standard (dB)	*81 Series* ELFEXT (dB)	CAT 6 Industry Standard (dB)	*81 Series* PS ELFEXT	CAT 6 Industry Standard (dB)	*81 Series* Return Loss	CAT 6 Industry Standard (dB)
0.772	1.6	≤ 1.8	86.0	≤ 76.0	84.0	≤ 74.0	70.0	≤ 70.0	67.0	≤ 67.0	‡	‡
1	1.8	≤ 2.0	84.3	≤ 74.3	82.3	≤ 72.3	67.8	≤ 67.8	64.8	≤ 64.8	20	20
4	3.6	≤ 3.8	75.3	≤ 65.3	73.3	≤ 63.3	55.7	≤ 55.7	52.7	≤ 52.7	23	23
8	5.1	≤ 5.4	71.8	≤ 60.8	68.8	≤ 58.8	49.7	≤ 49.7	46.7	≤ 46.7	24.5	24.5
10	5.8	≤ 6.0	69.3	≤ 59.3	67.3	≤ 57.3	47.8	≤ 47.8	44.8	≤ 44.8	25	25
16	7.3	≤ 7.6	66.3	≤ 56.3	64.3	≤ 54.3	43.7	≤ 43.7	40.7	≤ 40.7	25	25
20	8.2	≤ 8.5	64.8	≤ 54.8	62.8	≤ 52.8	41.7	≤ 41.7	38.7	≤ 38.7	25	25
25	9.2	≤ 9.6	63.3	≤ 53.3	61.3	≤ 51.3	39.8	≤ 39.8	36.8	≤36.8	24	24
31.25	10.4	≤ 10.7	61.9	≤ 51.9	59.9	≤ 49.9	37.9	≤ 37.9	34.9	≤34.9	24	24
62.5	15.0	≤ 15.5	57.4	≤ 47.4	55.4	≤ 45.4	31.8	≤ 31.8	28.8	≤28.8	22	22
100	19.3	≤ 19.9	54.3	≤ 44.3	52.3	≤ 42.3	27.8	≤ 27.8	24.8	≤24.8	20	20
200	28.3	≤ 29.2	49.8	≤ 39.8	47.8	≤ 37.8	21.7	≤ 21.7	18.7	≤18.7	18	18
250	32.1	≤ 33.0	48.3	≤ 38.3	46.3	≤ 36.3	19.8	≤ 19.8	16.8	≤16.8	17	17
300	35.6	‡	47.2	‡	45.2	‡	18.2	‡	15.2	‡	17	‡
350	38.9	‡	46.2	‡	44.2	‡	16.9	‡	13.9	‡	16	‡
400	42.0	‡	45.3	‡	43.3	‡	15.7	‡	12.7	‡	16	‡
450	45.0	‡	44.5	‡	42.5	‡	14.7	‡	11.7	‡	16	‡
500	47.9	‡	43.8	‡	41.8	‡	13.8	‡	10.8	‡	15	‡
550	50.6	‡	43.2	‡	41.2	‡	12.9	‡	9.9	‡	15	‡

3. 2081 Electrical Specifications

Category 6 cables **Guaranteed electrical performance** to 550 MHz:

‡ Not Specified

Physical specifications:

	Plenum
Conductor size	24AWG
Flute	✔
Diameter	.24” nominal
Weight/k*	31.7 lbs.

* Reel weight is an additional 2.25 lbs.

E. Jacks

1. The modular telecommunications outlets should be 8 position/8 conductor high density modular Information jacks designed for high speed

networking applications using data transmission rates with frequencies up to 550 mhz. The MGS300BH outlet is universal and can be wired for either T568A or T568B pinnouts and is designed to snap into any M-Series modular faceplate. All County terminations shall use the T568B wiring pinnout.Comcode: 108 601 899 Gray, 108 601 816 Orange

F. Faceplates

1. The M12AS will support two modules and is designed to be used in modular furniture raceway covers. (This is a plastic type faceplate that is flushmount and holds the I/O's at a 45 degree angle. Furniture faceplates would include the M13CLS, M14CE, M14C, M13C)

2. The M12AP is a duplex-outlet that is designed with perpendicular openings. This faceplate is used as a flush mounted multi-outlet. Other modular faceplates may also be used in triplex, quadplex or sixplex installations. (This is a verticle faceplate one hole on top of another in a line.) For traditional flushmount faceplates use the M12L or M12LE.

3. Wall faceplates shall match electrical faceplates in the building.

G. Fiber Optic Cable

1. Fiber should be utilized to interconnect all TRs to ICs and the MC.

2. The 50 micron MM fiber shall support single-channel serial transmission, in both the building riser and campus backbones, to 10 gigabits per second (Gb/s) for a distance of 300 meters with 4 connections.

   a. The 50 micron fiber shall be backward compatible with legacy applications such as: Ethernet, Token Ring, FDDI, Fast Ethernet and Atm for in-building network distances) ensuring a smooth migration path from 10Mb/s to 10 Gb/s using achievable technology.

   b. It shall support 10 Gb/s short wavelength (850 nm) emerging technology applications using vertical cavity surface emmitting lasers (VCSELs)and low bit rate LED applications for legacy systems.

   c. The 50 micron fiber shall be optimized to control differential mode delay (DMD) so that “pulse splitting” at 10 Gb/s is eliminated.

   d. The high performance fiber shall use the same termination and test procedures that are currently used for the existing industry’s lower

performance 50 micron fiber. Fibers shall be manufactured with D-LUX® 100 coating for maximum color retention and protection.

e. The 50 micron fiber shall meet or exceed the following standards, as applicable, for OSP or Plenum cables: ICEA S-83-596, ISO/IEC-794, GR-409, EIA/TIA 455, EIA/TIA 492, EIA/TIA 568A-5, ANSI-FDDI, IEEE 802, UL 910, OFNP classification as described in the National Electric Code (NEC2), OFN-LS Low Smoke Cables, CSA Certified (OFN FT4/FT6) and SYSTIMAX SCS approved component industry standards.

3. Multimode fiber specifications:

The 50 micron multimode plenum building riser fiber shall meet the following technical specifications:

Optical fiber	50 micron multimode (10 Gigabit)
Fiber dimension	125 micron cladding 250 micron coating 900 micron buffering
Fiber proof stress	100 kpsi (689 N/mm2)
Fiber core	50 µm (±2 µm)
Core non-circularity	< 6%
Core/cladding concentricity error	< 3.0 µm
Numerical aperture	0.200 +0.015/-0.010
Cladding diameter	125 µm (± 1 µm)
Cladding non-circularity	< 2%
Colored fiber diameter	250 µm (± 15 µm)
Buffering diameter	890 mm (± 50 mm)
Minimum tensile strength	100,000 psi
Fiber minimum bending radius	0.75 inch (1.19 cm)
Cable minimum bending radius	20 times cable diameter during installation 10 times cable diameter after installation
Maximum fiber loss	3.5 dB/km at 850 nm 1.5 dB/km at 1300 nm
Minimum Bandwidth	500 MHz-km at 850 nm (overfilled) 500 MHz-km at 1300 nm (overfilled) 2200 MHz-km at 850 nm (laser) 500 MHz-km at 1300 nm (laser)
Fiber identification	Individually color coded buffering
Buffer material	Plenum – Low Smoke PVC Color Coded
Jacket material	Plenum – Low Smoke PVC Aqua Color
Strength material	Aramid yarn

Operating temperature	(0dB added) -4°F to + 158°F (-20°C to +70°C)
Operating temperature	(less than 1.0dB added) -40°F to + 185°F (-40°C to +85°C)
Storage temperature	-40°F to + 158°F (-40°C to +70°C)
Normal reel length	Approx 12,000 feet (3,650m) (other lengths available)
Reel size	36" diameter, 19" wide alternate size 30" Diameter, 19" Wide

The 50 micron multimode plenum building riser fiber shall meet the following mechanical, environmental and optical testing requirements:

Cable Test	**Test Method**	**Multimode Requirement**
Temperature Cycling	TIA/EIA-455-3A; Test Cond. B-1	0.60 dB/km at 1300nm
Cable Aging	TIA/EIA-455-3A; Test Cond. B-1	1.20 dB/km at 1300nm
Strippability	TIA/EIA-455-178 FOTP-178	*Tight Buffered Fiber*: strip to the glass" 15mm +/- 1.5mm (.6 in +/- .06 in) of 900 um coating shall be removed with < 13.3N (3.0 lb-ft) and > 1.3N (.3 lb-ft) force. *Loose Buffered Fiber*: "strip leaving coating intact" 15mm +/- 1.5mm of 900 um coating shall be removed with < 13.3N (3.0 lb-ft)
Cyclic Flexing	TIA/EIA-104A	< .30dB for 90% of samples with 10% with loss .40dB
Impact	TIA/EIA-455-25A	MM loss< .30 dB for 90% of samples with 10% with loss .40dB
Cable Twist	TIA/EIA-455-85A	MM loss< .30 dB for 90% of samples with 10% with loss .40dB
High and Low Temperature Bend	TIA/EIA-455-37A	MM loss < .40 dB jacket cracking is failure; fiber break is failure
Compression	TIA/EIA-455-41A	MM loss < .40 dB No visible jacket damage allowed
Tensile Loading and Bending	TIA/EIA-455-33A	MM loss < .30 dB for 90% of samples with 10% with loss .40 dB

Avaya Communication BC-002D-ZPX, BC-004D-ZPX, BC-006D-ZPX, BC-012D-ZPX ACCUMAX LazrSPEED™ Plenum Multimode Building Cable approved.

4. Outside Plant Cable

a. The outside plant cable shall have a core consisting of 6, 12, 24, 48, or 96 multimode 50 micron fibers and shall have the fibers separated into 12-fiber (or greater), color-coded binder groups surrounded by plastic core tubes.

b. The core shall be filled with a water-blocking compound and be suitable for underground conduit, direct burial or aerial applications.

c. The cable shall be of dielectric LXE design with nonmetallic strength members parallel to and along the outside of the core. The sheath jacket shall be High-Density Polyethylene (HDPE) affording environmental protection.

d. The cable shall comply with Bellcore, FDDI and EIA standards.

The 50 micron multimode outside plant fiber cable shall meet the following technical specifications:

Optical fiber	50 micron multimode (10 Gigabit)
Tensile Load Rating	600 pounds (2,779N)
Minimum Bend Radius	10 times cable diameter under no load 20 times cable diameter under load
Outer Diameter	6-48 fibers: 0.51 in (13mm) 50-96 fibers: 0.61 in (15.5mm)
Weight	6-48 fibers: 95 lbm/kft (141 kg/km) 50-96 fibers: 125 lbm/kft (186 kg/km)
Operating Temperature Range	-40°F to + 158°F (-40°C to 70°C)
Minimum Bandwidth	500 MHz-km at 850 nm (overfilled) 500 MHz-km at 1300 nm (overfilled) 2200 MHz-km at 850 nm (laser) 500 MHz-km at 1300 nm (laser)
Maximum Attenuation	3.5 dB/km @ 850 nm 1.5 dB/km @ 1300 nm

The 50 micron multimode outside plant fiber shall meet the following mechanical, environmental and optical testing requirements:

Cable Test	**Test Method***	**OSP requirements**	**Notes**
Tensile Loading and Bending	EIA/TIA-455-33 IEC 60794-1-E1	0.30 dB Max. Mean Added Loss	2
Cyclic Flexing	EIA/TIA-455-104 IEC 60794-1-E6	0.20 dB Max. Mean Added Loss	2
Cyclic Impact	EIA/TIA-455-25	0.40 dB Max. Mean Added	2

	IEC 60794-1-E4	Loss	
Compressive Loading	EIA/TIA-455-41 IEC 60794-1-E3	0.20 dB Max. Mean Added Loss 440 N/cm (250 lbf/in) Load	2
Twist	EIA/TIA-455-85 IEC 60794-1-E7	0.20dB Max. Mean Added Loss	2
Low and High Temperature Bend	EIA/TIA-455-37 IEC 60794-1-E11	0.40dB Max. Mean Added Loss	2
External Freezing	EIA/TIA-455-98 IEC 60794-1-F6	0.20dB Max. Mean Added Loss	2
Fiber Strippability	EIA/TIA-455-178 No Equiv IEC proc	≤ 9.0 N (2 lbf) on unaged and aged fiber ≤ 1.0 N (0.2 lbf) on unaged and aged fiber	2
Temperature Cycling	EIA/TIA-455-3 IEC 60794-1-F1	≤ 0.5 dB/km Max Added Loss 80% ≤ 0.25 dB/km Added Loss	2
Cable Aging	EIA/TIA-455-3 IEC 60794-1-F1	≤ 1.0 dB/km Max Added Loss 80% ≤ 0.5 dB/km Added Loss	2
Water Penetration	EIA/TIA-455-82 IEC 60794-1-F5	No flow after one hour from one meter length of cable	1
Sheath-to-Ground Dielectric Strength		≤ 20kV for all armored metallic sheaths	2
Lightning Conduction	EIA/TIA-455-181 IEC***	IECA** Category 1 for all armoured metallic sheaths†	2

Notes:
1. Routine Requirements (RR)
2. Qualification Requirement (QR)

* Avaya complies with the latest revision of the TIA/EIA Test Method (There is not exact correspondence of TIA/EIA Fiber Optic Test Procedures (FOTPs) and IEC Test Methods.)

** ICEA categories are equivalent to those of Telecordia (Bellcore) GR-20

***Standard not yet published, but is under active consideration

† Mini-LXE (Armored Drop) is Category 2

Avaya Communication LDNX-006-HXG, LDNX-012-HXG, LDNX-024-HXG,

LDNX-048-HXG and LDNX-096-HXG Multimode ACCUMAX LazrSPEED™ Dielectric Sheath Lightpack Cable Approved

5. 50 micron fiber apparatus

   a. High Density Termination Shelf (Rack Mount)

      1) The high density termination shelf shall be fully modular in design, provide security and protection, be accessible from both front and rear; and shall be capable of terminating buffered fiber optic building cable or direct termination of outside plant fibers.

      2) The shelf shall be a 4U (7-inch high) designed for mounting in a 19-inch frame and be capable of handling terminations for up to 144 LC, 72 SC or 72 STII+ connections; and shall be equipped with color coded adapter strips for easy identification of 50 micron fiber optic cable.

      3) The shelf shall contain built-in slack management for each adapter strip to facilitate fiber administration and have removable adapter bezels that are removable from the fron to permit easy access to the rear connector and fiber.

      4) Shelf dimensions: 7”h x 17”w x 11”d

   b. High Density Termination Shelf (Rack Mount) Acceptable Manufacturers

      1) Avaya Communication LSTLS High Density Termination Shelf approved
      2) Avaya Communication LSTLS/MM/LC-144/7 (108 565 631) approved
      3) Avaya Communication LSTLS/MM/SC-072/7 (108 565 649) approved
      4) Avaya Communication LSTLS/MM/ST-072/7 (108 565 656) approved

   c. Combination Shelves (Rack Mount)

      1) Combination shelf with stationary shelf

         a) The rack mount combination shelf shall be applicable for use in LANs, premises distribution

systems, and small-count splice and termination applications.

b) The rack mount shelf shall be one-unit-high and be capable of housing 24 ST, 24 SC or 48 LC terminations, and shall have a detachable front panel facilitating access to the cable and connectors.

c) The shelf shall be capable of 24 fibers (48 with LCs) or to accommodate 48 mechanical splices, 64 fusion splices or 12 ribbon (mass fusion) splices using optional splice trays.

d) The shelf assembly shall consist of an aluminum tray that contains rear-corner slots for cable entry, steel brackets for frame mounting, fiber retainers for holding buffered fiber in place, and fiber storage drums for maintaining a bend radius of 1.5 inches (3.81) cm) for buffered fiber.

e) An optional door and cable manager shall be available for use when two shelves are stacked for an asthetic appearance. This optional accessory shall be a 1U high (1.75") with a 3U door (5.25"). A top cover shall be available to protect from dust and falling debris.

f) Shelf dimensions: 1.72" (4.37 cm) H x 17.0" (43.18 cm) W x 8.0" (20.32 cm) D

2) Combination shelf with stationary shelf Acceptable Manufactures

a) Avaya Communication 600ALS Combination Shelf Approved

b) 600ALS/MM/LC-48 Shelf for 48 LC connectors (108 565 698) Approved

c) 600ALS/MM/SC-24 Shelf for 24 SC connectors (108 565 706) Approved

d) 600ALS/MM/ST-24 Shelf for 24 ST connectors (108 565 714) Approved

e) Options:
   1 600ALS Lid Cover (108 565 433) Approved
   2 DTLS/600A-5 Door with cable manager (108 565 482) Approved
   3 1AF1-16LG Fusion Splice Organizer (105 356 562) Approved
   4 1AMF1-6LG Mass Fusion Splice Organizer (105 545 451) Approved
   5 1AM1-12LG Mechanical Splice Organizer (105 356 570) Approved

3) Combination shelf with sliding tray

a) The combination shall have a sliding tray with two 3-inch (7.7 cm) storage drums and two openings with liquid-tight cable fasteners. The sliding tray allows front access and installation of fibers.

b) The rack mount combination shelf shall be applicable for use in LANs, premises distribution systems, and small-count splice and termination applications.

c) The rack mount shelf shall be one-unit-high and be capable of housing 24 ST, 24 SC or 48 LC terminations.

d) The shelf shall be capable of 24 fibers (48 with LCs) or to accommodate 48 mechanical splices, 64 fusion splices or 12 ribbon (mass fusion) splices using optional splice trays.

e) The sliding tray shall ride on two self-locking nylon slides used for pulling the shelf away from the frame for front access to fibers.

f) An optional door and cable manager shall be available for use when two shelves are stacked for an asthetic appearance. This optional accessory shall be a 1U high (1.75") with a 3U door (5.25"). A top cover shall be available to protect from dust and falling debris.

g) Shelf dimensions: 1.72" (4.37 cm) H x 17.19" (43.7 cm) W x 11.20" (28.5 cm) D

4) Combination shelf with sliding tray Acceptable Manufactures

a) Avaya Communication 600BLS Combination Shelf Approved
b) 600BLS/MM/LC-48 Shelf for 48 LC connectors (108 565 755) Approved
c) 600BLS/MM/SC-24 Shelf for 24 SC connectors (108 565 763) Approved
d) 600BLS/MM/ST-24 Shelf for 24 ST connectors (108 565 771) Approved
e) Options:
1 600BLS Lid Cover (108 565 458) Approved
2 DTLS/600B-1.75 Door with cable manager (108 565 513) Approved
3 1AF1-16LG Fusion Splice Organizer (105 356 562) Approved
4 1AMF1-6LG Mass Fusion Splice Organizer (105 545 451) Approved
5 1AM1-12LG Mechanical Splice Organizer (105 356 570) Approved

6. Distribution Panel (Wall/Rack Mount)

a. The distribution panel shall fit 1U rack space (1.72" high x 19" wide x 4.75" deep) and shall also be wall mountable with optional wall mount brackets.

b. The distribution shall be capable of terminating 48 LC, 24 SC or 24 ST connectors.

c. Color coded adapter shall be available to facilitate identification and administration of fibers.

d. Front access to the connectors and fibers shall be provided by removal of the adapter bezel from the front of the panel.

7. Distribution Panel (Wall/Rack Mount) Acceptable Manufactures

a. Avaya Communication 1100LS Fiber Distribution Panel Approved
b. 1100LS/MM/LC-48 Panel for 48 LC Connectors (108 565 557) Approved
c. 1100LS/MM/SC-24 Panel for 24 SC connectors (108 565 573) Approved

d. 1100LS/MM/ST-24 Panel for 24 ST connectors (108 565 581) Approved

e. Options:

1) Door with Cable Manager DTLS/600A-5 (108 565 482) Approved

2) 3.5" Wall Adapter 1100C1-35-19 (106 830 573) Approved

3) 7" Wall Adapter 1100C2-70-19 (106 830 581) Approved

8. LIU Termination Unit (Wall / Rack Mount)

a. The LIU termination unit shall be a modular enclosure that provides cross connect and /or interconnect, splicing and terminating capabilities for outside plant and building cables. Although the LIUs are designed to be wall mounted they shall be rack mountable using available brackets.

b. The LIUs shall be available in the following two size capacities:

1) The LIU shall be made of engineered polycarbonate material.

2) The LIU shall accept two adapter panels capable of terminating 12 fibers with SC/ST connectors or 24 fibers with LC connectors. It shall accommodate up to 12 mechanical or 12 fusion splices with an optional splicing kit.

3) Dimensions: 8.75" high x 7.5" wide x 3" deep

4) Avaya 100LS, 100 LIU Termination Unit (108 548 868) Approved *Note: Chose adapter panels and fiber splicing accessories from list below*

c. The LIU shall be made of aluminum.

1) The LIU shall accept four adapter panels capable of terminating 24 fibers with SC/ST connectors or 48 fibers with LC connectors. It shall accommodate up to 24 mechanical or fusion splices with an optional splicing kit, but fiber termination is decreased to 12 ST or 24 LC connections.

2) Dimensions: 8.75" high x 7.5" wide x 4" deep

3) Avaya 200LS, 200 LIU Termination Unit (108 548 876) Approved *Note: Chose adapter panels and fiber splicing accessories from list below*

4) Avaya Adapter Panels approved:
   a) LC adapter panel 10PLC-LS (108 627 266) approved
   b) SC adapter panel 10PSC-LS (108 627 274) approved
   c) ST adapter panel 10PST-LS (108 627 282) approved

5) Avaya Splicing Accessories approved:
   d) Mechanical Splice Kit D-181706 (105 289 656) approved
   e) Fusion Splice Kit D-181707 (105 289 664) approved
   f) Supplemental Mechanical Splice Kit* (106 726 714) approved
   g) Supplemental Fusion Splice Kit* (106 726 705) approved
   h) *Mechanical and Fusion Splice Kits are used for the first 12 splices. Supplemental Splice Kits can accommodate additional splices.*

d. Termination Panel (Rack Mount)

1) The termination panels shall be constructed of lightweight aluminum and comply with the EIA RS-310D standard for 19-inch (48.2 cm) frames. The panels shall mount on either a 19-inch rack/frame or 1100C-type wall mounted brackets.

2) The termination panels shall accept fiber distribution modules equipped with LC, STII+ or SC connectors for maximum flexibility. The termination panels shall be of two size capacities: 4-module panel (terminates 24 ST or SC connections, or 48 LC connections)and 8-module panel (terminates 48 ST or SC connections, or 96 LC connections).

3) Each ST or SC distribution module shall terminate 6 fibers. Each LC distribution module shall terminate 12 fibers.

4) Distribution modules shall snap into panel facilitating field assembly, installation and change-outs.

5) Fiber slack trays shall attach to the rear of the modules providing slack storage and proper bend radius of fibers. The fiber slack trays and modules shall be front removable.

6) Each module shall incorporate hinge-mounted, flip-up covers to protect adapter ports.

7) Dimensions:

a) 4-Module Panel – 2U (3.5" h x 19" h x 8" d)
b) 8-Module Panel – 4U (7" h x 19" h x 8" d)

8) Acceptable Manufacturers

a) Avaya Patchmax Termination Panel approved
b) 2U Termination Shelf Kits:
c) PM2304LC/LC-48 for 48 LC Connections (108 662 024) approved
d) PM2304SC/SC-24 for 24 SC Connections (108 662 065) approved
e) PM2304ST/ST-24 for 24 ST Connections (108 662 107) approved
f) 4U Termination Shelf Kits:
g) PM2304LC/LC-96 for 96 LC Connections (108 662 040) approved
h) PM2304SC/SC-48 for 48 SC Connections (108 662 081) approved
i) PM2304ST/ST-48 for 48 ST Connections (108 662 123) approved

e. Connectors and Adapters

1) The 10Gb/s 50 micron multimode fiber optic cable shall terminate on the following listed approved connectors and adapters:

a) Avaya Communication Connectors approved:
b) P1001A-Z-125 Multimode LC Connector (0.9 mm buffer) (107 764 292)
c) P2020C-Z-125 Multimode STII+ Connector (0.9 mm buffer) (106 812 274)
d) P6201A-Z-125 Multimode SC Connector (0.9 mm buffer) (106 917 800)
e) Avaya Communication Adapters approved:

f) C1001B-2-LS LazrSPEED LC Duplex Adapter (108 622 887)
g) C6061A-4-LS LazrSPEED SC Duplex Adapter (108 622 895)
h) C2000A-2 Multimode ST Adapter (104 148 028)
i) M81LS-LS Spool LC Duplex Adapter with fiber spool (108 623 109)

f. Patch Cords

1) The 10 Gb/s 50 micron multimode fiber optic solution shall utilize factory made patch cords. The patch cords shall be available in 4 ft, 6 ft, 10 ft, 20 ft, 30 ft, 40 ft, and 50 ft. lengths.

2) Avaya Communication Patch Cords approved:
3) Avaya Communication Duplex MiniCord Patch Cords
4) LC to LC MiniCord Patch Cord M22LC-LC-xx
5) LC to SC MiniCord Patch Cord M22LC-SC-xx
6) LC to STII+ MiniCord Patch Cord M22LC-EP-xx
7) STII+ to STII+ MiniCord Patch Cord M22EP-EP-xx
8) SC to SC MiniCord Patch Cord M22SC-SC-xx
9) Avaya Communication Duplex MiniCord MTRJ Patch Cords
10) LC to MTRJ MiniCord Patch Cord M22LC-MJ-xx
11) SC to MTRJ MiniCord Patch Cord M22SC-MJ-xx
12) STII+ to MTRJ MiniCord Patch Cord M22EP-MJ-xx

13) Avaya Communication 3.0 mm Patch Cords
a) STII+ to STII+ Patch Cord LZEP-EP-xx
b) SC to SC Patch Cord LZ2SC-SC-xx
c) SC to STII+ Patch Cord LZ2SC-EP-xx

4.5 CABLE INSTALLATION REQUIREMENTS

A. The purpose of this section of the County Wiring and Cable Standard is to provide a general outline of the installation specifications that will be required of any contractor selected to provide the installation of wiring and cabling as defined in these standards. The installation specifications are a minimum requirement.

B. Cable vendors must be a certified Avaya Systimax SCS Installer or reseller and must provide a Avaya extended product warranty and applications assurance upon completion of the system.

C. Work Covered.

1. The work covered by these guidelines consists of furnishing and installing all equipment, materials, labor and services; related work; and performing all operations necessary to install and test the communications cabling system in all locations of each County building. The contractor shall provide all supervision, transportation, inspection, inventory and permanent records. The work shall include, but not be limited to, the following items:

    a. Information jacks: Administrative areas, work areas and LAN/computer areas
    b. Cable termination and patch panels
    c. Cabling (outdoor, indoor)
    d. Connectors, couplers, and panels
    e. Fiber optic splices and splice enclosures
    f. Hangers, brackets, mounting hardware and frame mountings
    g. Tie wraps, bushings and miscellaneous parts
    h. Conduits, innerducts, and fire-stop materials
    i. Tools and equipment necessary to complete the installation
    j. Cable sleeves and openings for routing backbone cabling
    k. Testing
    l. Protection of the County's premises and employees

D. Securing Cables.

1. Cables shall be securely held in place by an industry acceptable practice and installed with sufficient bending radius so as not to kink, shear or damage electrical conductors or optical fibers. Pulling tension shall be monitored with a dynamometer (tension gauge) to ensure that recommended tensile ratings are not exceeded.

E. Quantity of materials.

1. The contractor shall calculate all actual cable footage required. Contractor shall prepare a preliminary cable and wiring plan after inspecting the building plans, which describes the general methods to be applied in wiring the County's facilities. Such preliminary cable and wiring plan shall be included with contractor's proposal and shall include costs of each cable

F. Coordinate project phasing.

1. The contractor shall continuously coordinate work schedules and other details with the County's construction representative or designee.

2. Prior to installation, the contractor shall examine and measure existing construction in involved areas, report conditions that interfere with or

prevent correct installations and report conflicts between documents and actual conditions.

3. The designated voice/data TRs or areas will be available to the contractor on a coordinated basis with the general contractor or the County's representative. The contractor shall be responsible for the shipping, handling, and storage of all equipment and materials, and to protect it from theft.
4. The contractor shall obtain permission before proceeding with any work necessitating cutting into or through any part of the building structure such as girders, beams, concrete, finished floors or partition ceilings.

G. Repair of existing construction.

1. Contractor shall restore to original condition, at the contractor's expense, existing construction and improvement that are cut into, altered or damaged due to the contractor's operations. This includes matching adjoining surfaces and finishes.

H. Contractor must provide accurate cable records.

1. The contractor shall provide final cable records which detail copper riser and fiber optic backbone cable number, fiber count, pair count, telecommunications Room location, and type instrument. All jack locations shall be marked with a non-removable means. Records shall be provided in both electronic and paper format.

I. Final inspection of job.

1. Upon completion of all work functions, a final inspection or walk through with County representatives and the local Avaya SYSTIMAX Account Executive shall occur.

J. Shop Drawings.

1. Shop drawings shall include all parameters of operations and functions of the information cabling system, including all equipment, accessories, supporting details and their technical specifications. They should include drawings, manufacturers' catalogs, product codes, installation procedures, test procedures, and environmental conditions.

2. Drawings shall include cable routes, termination points, pair and fiber assignments, labeling scheme and sample, proposed method of installation, and a schedule of work. Drawings shall be provided in electronic format compatible with the County's GIS.

3. Contractor shall provide at least four (4) copies of the above details for the County's review and approval within fifteen (15) work days after award of the contract.

K. Specific Installation Requirements - Fiber

1. Fiber Optic Termination Panels:

a. Fiber optic termination panels shall be installed in the building TRs and MC as shown on the preliminary drawings and schedules. The panels shall be equipped with connector couplings for full capacity.

b. ST-II connector couplings at the termination panels shall be protected with end caps at all times.

L. Specific Installation Requirements - Other

1. The contractor must coordinate and work with the County and/or General Contractor on installation phases.

2. Voice and data station cables shall be terminated at patchmax panels for data and 110P for voice in the building TRs and MC. All cables shall be continuous runs without splices between any two terminations or end points. However, the distance minimums for data must be assured.

3. The maximum run of horizontal cable from any workstation to a TR must not exceed 90 meters. In buildings requiring risers, the horizontal distance is an extension of the backbone (riser) distance.

4. Note: The voice services will be distributed on CAT6 which will permit future expanded data networking within each building.

5. The horizontal cabling shall consist of two, four-pair cables for each jack (two cables times 4 pair times two RJ45 jacks) at workstation wall plate where a telephone and/or computer will be located. Horizontal cables shall be terminated at both ends.

6. The subsystems shall be cross-connected for end-to-end connectivity.

7. The cables shall be labeled and numbered at each end and at intermediate access locations. Workstation jacks patchmax and 110P patch panels shall also be labeled according to the SYSTIMAX® SCS guidelines.

4.6 General Construction Requirements

A. The contractor shall be responsible for removing or laying aside ceiling tiles in order that it may complete its installation. When the installation has been completed in an area, the contractor shall replace the ceiling tiles immediately at the contractor's cost.

B. The contractor shall be responsible for drilling the access holes to gain access through a wall or floor (or coordinating with the building's general contractor). Access holes in the buildings shall not be greater than two or three times the diameter of the cable being installed. The contractor shall provide sleeves at floor access holes, and protection above and below the floor and above surfaces where drilling occurs.

C. Once all backbone cables have been placed, all sleeves and other passageways for carrying the backbone cable shall be plugged with an approved fire retardant plugging compound at each fire barrier penetration to meet local code requirements.

D. The Contractor(s) shall at all times keep the adjacent areas of the property free from rubbish and the accumulation of any waste materials.

E. Cable System Bonding and Grounding

F. Bonding and grounding of all cables, frames and equipment shall be accomplished in accordance to NEC Article 250 and TIA/EIA-607. If ARMM riser cables are utilized, all cable sheaths shall be bonded to the termination panel using number 6 copper wire.

G. All sheaths shall be bonded across any openings. Shield shall be grounded to one end only.

4.7 Testing and Acceptance

A. The contractor shall provide a thorough and current testing program for cabling acceptance testing. The testing should be done according to data equipment specifications as well as generally accepted practices.

B. The County will assume voice is acceptable if all CAT 6 cable runs pass data testing. The County's representative may observe any or all testing.

C. Final acceptance testing shall be performed jointly by the contractor and the County representative.

D. The contractor shall provide porcedures and a list of test equipment and operating instructions before the test. The contractor shall be responsible for understanding

the latest Systimax® SCS test standares in order to insure the maximum benefit of the current Avaya guarantee (currently twenty (20) years.

E. Testing of all copper wiring shall be performed prior to system cutover. 100 percent of the horizontal and riser wiring pairs shall be tested. Voice and data horizontal wiring pairs shall be tested from the information outlet to the TC. Testing shall be done with a TIA/EIA TSB-67 UL Certified Level III test set. For all unshielded twisted-pair connections, tests shall include, but not necessarily be limited to, polarity reversals, wire transpositions, continuity, AC and DC voltage, opens, shorts, power and ground faults and proper station operating conditions. Test shall also include length, mutual capacitance, characteristic impedance, attenuation, and near-end and far end crosstalk.

F. Subsystems shall be tested individually before testing for end-to-end connectivity.

G. All faults shall be corrected and tested. All test results shall be completely documented.

4.8 Fiber Optic Tests

A. An Optical Loss Set (OLS) which combines the optical power meter (OPM) and optical source with adjustable output power level shall be used. The OLS/OPM shall display measured transmission loss directly in dB by comparing the optical power received after transmission through the fiber path to its own optical source power. Once this difference is adjusted to "zero" for a cable under test, all fibers in that cable are then measured relative to the "zeroed" source power and displayed in dB. The 938A OLS/OPM, Comcode 104 374 137, meets these requirements.

B. Tests shall be conducted at the wavelengths of 850 nm and 1300 nm and loss will be measured in the A to B direction, LAB, at B. The contractor will measure the loss in the B to A opposite direction, LAB, at A and calculate fiber path loss by averaging the loss measurements, (loss A to B + loss B to A) divided by 2. The 937A Optical Intercom (Comcode 104 373 129) can be used to provide two-way communication on fibers during testing. All measured and calculated losses shall be recorded in a table similar to the one shown below. The table shall also be available on PC-based spreadsheet in ASCII format.

C. Optical Fiber Transmission Loss Measurements:

Mode: Wavelength: Date: Page:

Hub Site Label	**Fiber Number**	**Color Code**	**Fiber Length Feet**	**Loss A to B dB**	**Loss B to A dB**	**Loss Average (E+F)/2dB**	**DesignLoss D/3284xM+ dB**

A	B	C	D	E	F	G	H

3284 feet = 1 kilometer = 1000 meters
M = 3.4 dB/km @ 850 nm, 1.00 dB/km @ 1300 nm
N = Connector Loss = number of connectors x 0.3dB loss each in a span

S = Splice Loss = .20 dB each splice in a cable span

D. All fiber path transmission losses must be compared with the design loss values. A fiber path loss which is higher than the design loss indicates a problem with the measurement or fiber path. The measured transmission loss is first confirmed using the above procedures, including cleaning and inspecting the connectors. Then the fiber path is checked to determine the cause or causes of high loss such as improperly constructed terminations, damaged connectors, pinched fiber, et cetera. All faults shall be corrected and retested.

4.9 Acceptance Tests

A. Upon completion of all tests, two copies of test results shall be submitted for review. Prior to cutover, the contractor shall perform a random sampling test jointly with the County's representative, of one in six workstation circuits selected by the County representative, to verify conformance to the specifications.

B. Tests shall be repeated for any faults found at this stage. Test documents shall be revised accordingly. A final walk through inspection with the County representative should be completed at this stage.

C. The County representative shall confirm, in writing, acceptance of the installation and tests upon receiving two copies of the final test results. A copy of the test results and Avaya Warranty Certificate shall be retained by the County as part of the permanent cable installation record per each building.

D. The Contractor shall provide the County an original warranty for each project. Final payment will not be made until the documentation, testing, and warranty documents are provided and accepted.

END OF SECTION 17200